

LABORATORY SPECTROSCOPY OF WATER-ICE TOWARDS STANDOFF DETECTION OF ICE IN THE PERMANENTLY SHADOWED CRATERS OF THE MOON. Murthy S. Gudipati, Science Division, Jet Propulsion Laboratory, California Institute of Technology, Mail Stop 183-301, 4800 Oak Grove Drive, Pasadena, California, USA (Gudipati@jpl.nasa.gov).

Introduction: Understanding surface and near-surface processes on the Moon is one of the key science issues pertinent to the NASA's Lunar Science roadmap. This includes: how near-surface volatiles are generated (chemistry / space weathering), how the surface is modified, and what is the nature of surface material in the extremely cold polar regolith. Finding water ice in the permanently shadowed polar craters of moon has an important implication for future human missions to the Moon [1, 2]. Presence of organics in these regions is still an open-ended question.

Spectroscopy of Ice: We have been carrying out laboratory research on the absorption and luminescence (fluorescence and phosphorescence) spectroscopy of water-ice imbedded with organic impurities. So far we have focused in the optical (UV-VIS-NIR 0.3 – 1.0 μm) region in which water-ice itself doesn't absorb, lending sensitive detection of impurities in the ices. Studies are underway both in the EUV (0.11 – 0.3 μm) and IR (1.0 – 50 μm) regions, where water-ice itself has strong absorption and emission features.

Radiation Chemistry of Ices: Using polycyclic aromatic hydrocarbons (PAHs) as probes, we found that high-energy radiation causes ionization processes

and may have been accumulating on Lunar surface as well, though so far undetected. We use PAHs as "probes" rather than their likeliness to be found on lunar polar regions.

Comprehensive Ice Spectroscopy: Cosmic rays and debris impacting the Lunar surface cause physical and chemical changes of the surface. Our studies show that ionization is the most prominent process in water-ices. Studies on Europa also show that the volatiles such as O, O₂, and other oxygen rich molecules such as H₂O₂ are produced in ices[5-7]. Thus, the present state of knowledge on radiation processing of water-ice together, we should expect all these species in the Lunar ices. Some of these and other ice radiolysis products may have stronger spectral signatures than the ice itself. Thus, we are focusing on a comprehensive laboratory spectroscopic study of water-ice and its radiolysis products with and without organic impurities in the spectral region 0.1 to 50 μm .

Implications to Lunar Science: In addition to epithermal neutron scattering technique to precisely locate subsurface water-ice reservoirs [8], laser-induced fluorescence can detect the tracks of water as mentioned above at standoff distances.

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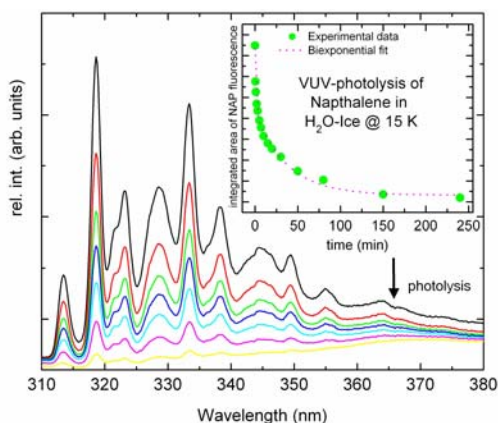


Figure 1: EUV radiation induced ionization of naphthalene impurity in water-ice followed through fluorescence spectroscopy.

in the water-ices [3, 4], as shown in Figure 1. Significant amount of PAHs are delivered through interstellar dust particles (IDPs) into the solar system

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